"Low-frequency Gravitational Wave Searches Using Spacecraft Doppler Tracking"

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The earth and a distant spacecraft can act as separated test masses in a gravitational wave detector sensitive to low-frequency (~0.0001-0.1 Hz) waves. In this technique, high precision Doppler tracking of the spacecraft using the NASA/JPL Deep Space Network continuously measures the relative dimensionless velocity, delta_v/c, between the earth and the spacecraft. A gravitational wave of strain amplitude h incident on the system produces three geometry-dependent events in the Doppler time series, each of order h in delta_v/c.

In this talk I will review the principles of operation and main noise sources in Doppler gravitational wave experiments, and review some of the results of previous S-band (~2.3 Ghz) and X-band (~8.4 GHz) gravitational wave searches. I will discuss the status and expected sensitivity of the upcoming Cassini experiment which, using a Ka-band (~32 GHz) link, is expected to be an order of magnitude better than earlier experiment. Finally, I will outline improvements required on the spacecraft and on the ground in order to do significantly better than Cassini with the Doppler technique.